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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/730,835	12/09/2003	Bijan Sayyarrodsari	PAVT016US0	5196

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EXAMINER	
PHAM, THOMAS K	

ART UNIT	PAPER NUMBER
2121	

DATE MAILED: 12/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/730,835	SAYYARRODSARI ET AL.	
	Examiner	Art Unit	
	Thomas K Pham	2121	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 December 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-39* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22 and 24-39* is/are rejected.

7)☒ Claim(s) *23 and 24* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 December 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

First Action on the Merits

1. Claims 1-39 of U.S. Application 10/730,835 filed on 12/09/2003 are presented for examination.

Quotations of U.S. Code Title 35

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Drawings

6. New corrected drawings in compliance with 37 CFR 1.121(d) are required in this application because figures 1-4 and 8-11 are not clearly show the lines and detail. Applicant is advised to employ the services of a competent patent draftsperson outside the Office, as the U.S. Patent and Trademark Office no longer prepares new drawings. The corrected drawings are required in reply to the Office action to avoid abandonment of the application. The requirement for corrected drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

7. Claims 1-9 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,933,345 ("Martin").

Regarding claim 1

Martin teaches a process controller comprising:

- controller variable inputs comprised of measurements of process variable inputs of the process being controlled (col. 9 lines 31-33, "a dynamic controller 82 ... to receive the input u(t)");
- a dynamic predictive model (fig. 6, element 80), of the process being controlled, with dynamic predictive model parameter(s) (fig. 6, element 92), for receiving current variable input values (col. 9 lines 13-14, "A predictive model 80 ... receives the input values u(t)") wherein the dynamic predictive model parameter(s) change(s) dependent on said variable input values received by the controller (col. 9 lines 39-42, "During the operation of the ... dynamic controller 82 in a block 88"); and

- output(s) from the dynamic model for generating controller outputs for effectuating change to the process being controlled (col. 9 lines 19-24, "The predicted steady-state ... control system seeks to achieve").

Regarding claim 2

Martin teaches the dynamic predictive model is further comprised of: a physical model with physical model parameters (fig. 2, dynamic model 22 with dynamic parameters 38); and an empirical model which adjusts the physical models parameters based on the controller variable inputs (col. 3 lines 34-45, "a gain adjustment device ... one of the time positions" [empirical model is the non-linear model adjusting the parameters of the linear dynamic model (physical model)]).

Regarding claim 3

Martin teaches the empirical models adjustments to the physical models parameters based on the controller variable inputs is further based on historical controller inputs (col. 3 lines 46-52, "the gain adjustment device further ... by the parameter adjustment device").

Regarding claim 4

Martin teaches the physical model is a first principles model of the process being controlled (col. 21 lines 35-38, "Referring now to FIG. 22 ... the first principles model").

Regarding claims 5 and 6

Martin teaches the empirical models is non-linear neural network model (col. 17 line 26, "a neural network is an empirical model").

Regarding claim 7

Martin teaches the physical model is a first principles model of the process being controlled and

the empirical model is a non-linear neural network that adjusts the parameters of the first principle model based on the controller variable inputs (col. 21 lines 36-66, "realizing the switching between ... operation in the first principles block 302").

Regarding claim 8

Martin teaches the physical model is a first principles model of the process being controlled and the empirical model is a non-linear neural network that adjusts the parameters of the first principle model based on the current controller variable inputs (col. 21 lines 36-66, "realizing the switching between ... operation in the first principles block 302").

Regarding claim 9

Martin teaches the physical model is a first principles model of the process being controlled and the empirical model is a non-linear neural network that adjusts the parameters of the first principle model based on the current and historical controller variable inputs (col. 21 lines 36-66, "realizing the switching between ... operation in the first principles block 302").

Regarding claim 25

Martin teaches a dynamic process controller predicting a change in the dynamic variable input values to the process to effect a change in the controlled variable output of the process from a current controlled variable output value at a first time to a different and desired controlled variable output value at a second time, comprising:

- a dynamic predictive model for receiving the current variable input value (col. 9 lines 13-14, "A predictive model 80 ... receives the input values u(t)"), wherein said dynamic predictive model changes dependent upon said variable input value, and the desired controlled variable output value (col. 9 lines 19-24, "The predicted steady-state ...

control system seeks to achieve"), and wherein said dynamic predictive model produces a plurality of desired controlled variable input values at different time positions between the first time and the second time to define a dynamic operation path of the process between the current controlled variable output value and the desired controlled variable output value at the second time (col. 2 lines 55-61, "a dynamic predictive model ... output value at the second time"); and

- an optimizer for optimizing the operation of the dynamic controller over a plurality of the different time positions in accordance with a predetermined optimization method that optimizes the objectives of the dynamic controller to achieve a desired path, such that the objectives of the dynamic predictive model vary as a function of time (col. 2 lines 61-67, "An optimizer then optimizes ... as a function of time").

Regarding claim 26

Martin teaches wherein said dynamic predictive model comprises:

- a dynamic forward model operable to receive variable input values at each of said time positions and map said variable input values to components of said dynamic predictive model associated with said received variable input values in order to provide a predicted dynamic controlled variable output value (col. 3 lines 1-5);
- an error generator for comparing the predicted dynamic controlled variable output value to the desired controlled variable output value and generating a primary error value as the difference for each of said time positions (col. 2 lines 4-9);
- an error minimization device for determining a change in the variable input value to minimize the primary error value output by said error generator (col. 2 lines 9-11);

- a summation device for summing said determined variable input change value with an original variable input value, which original variable input value comprises the variable input value before the determined change therein, for a plurality of time position to provide a future variable input value as a summed input value (col. 2 lines 11-14); and
- a controller for controlling the operation of said error minimization device to operate under control of said optimizer to minimize said primary error value in accordance with said optimization method (col. 2 lines 14-17).

8. Claims 10-24 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 6,278,899 ("Piche").

Regarding claim 10

Piche teaches a process control system comprising:

a distributed control system (fig. 6, element 86) that further comprises:

- a computing device operable to execute a first software tool that identifies variable inputs including at least one manipulated variable input and controlled variables associated with the process (col. 38 lines 3-13, "Basically, there is illustrated a plant 480 ... parameters for control thereof"), wherein said first software tool is further operable to determine relationships between said variable input(s) and said controlled variables (col. 38 lines 35-41, "The GUI interface 490 ... the actual control variable"); and

- at least one controller operable to monitor said variable input parameter(s) and tune said manipulated variables (col. 39 linrd 32-41, "These ouputs are input to ... of the inputs to the plant 600").

Regarding claim 11

Piche teaches said relationships between said variable input(s) and said controlled variables comprises a first principle model(s) with model parameters wherein said first principle model parameter values are dependent on said variable input(s) (col. 23 lines 28-30, "The output of the first principles ... to receive the input x(t)").

Regarding claim 12

Piche teaches neural networks utilized to identify said model parameters (col. 10 lines 2-5, "a method for determining the ... the a_i and b_i parameters").

Regarding claims 13 and 29

Piche teaches said step of determining relationships between said variable input(s) and said controlled variables utilizes a neural network (col. 6 lines 57-63, "The linear dynamic operator model 12 ... a two layer neural network").

Regarding claims 14 and 31

Piche teaches said step of determining the relationship between said variable inputs and said controlled variables utilizes a combination of physical models and empirical methods (col. 7 lines 45-61, "there are provided a static ... steady-state value in the latch 24").

Regarding claim 15

Piche teaches wherein said physical models and empirical methods are combined in parallel and/or in series (fig. 2 shows dynamic model (physical) 22 in parallel with steady-state model

(empirical) 20).

Regarding claims 16 and 34

Piche teaches wherein said physical model parameter(s) varies over an operating range (col. 21 lines 10-22, "At the initial steady-state ... the final steady-state value").

Regarding claims 17 and 35

Piche teaches wherein said physical model is a function of said variable input(s) (col. 7 lines 6-14, "Once the steady-state model ... by the linear dynamic model").

Regarding claims 18 and 36

Piche teaches wherein said physical model comprises first principle parameters which vary with said variable input(s), wherein empirical methods comprise a neural network used to identify first principle parameter values associated with said variable input(s) and wherein said neural network updates said first principle parameters with values associated with said variable input(s) (col. 23 lines 10-40, "realizing the switching between ... operation in the first principles block 302").

Regarding claims 19 and 37

Piche teaches wherein said neural network is trained (col. 7 lines 3-5, "Once trained, the network ... in a separate database").

Regarding claims 20 and 38

Piche teaches wherein said neural network is trained according to at least one method selected from the group consisting of: gradient methods (col. 15 line 24), back propagation (col. 3 lines 10-11), gradient-based nonlinear programming methods (col. 30 lines 27-28), sequential quadratic programming (col. 11 lines 49-52), generalized reduced gradient methods (col. 29 lines

50-65), and non-gradient methods (col. 3 lines 12-13).

Regarding claims 21 and 39

Piche teaches wherein gradient methods require gradients of an error with respect to a weight and bias obtained by numerical derivatives (col. 29 lines 55-57, "during training of feedforward ... squared error over a train set").

Regarding claim 22

Piche teaches wherein gradient methods require gradients of an error with respect to a weight and bias obtained by analytical derivatives (col. 7 lines 3-5, "Once trained, the network ... in a separate database").

Regarding claim 27

Piche teaches a method for controlling operating process, comprising the steps of:

- identifying variable input(s) and controlled variables associated with the process, wherein at least one variable input is a manipulated variable (col. 38 lines 3-13, "Basically, there is illustrated a plant 480 ... parameters for control thereof");
- determining relationships between said variable input(s) and said controlled variables wherein said relationship comprises models, and wherein parameters within said model are dependent on said variable inputs (col. 38 lines 35-41, "The GUI interface 490 ... the actual control variable"); and
- tuning said manipulated variable to achieve a desired controlled variable value (col. 39 linrd 32-41, "These ouputs are input to ... of the inputs to the plant 600").

Regarding claim 28

Piche teaches determining the relationship between the variable inputs and the model parameters wherein said relationship comprises a model (col. 6 lines 57-63, "The linear dynamic operator model 12 ... a two layer neural network").

Regarding claim 30

Piche teaches identifying relationship between the variable input(s) and dynamic model parameters utilizes neural networks (col. 6 lines 57-63, "The linear dynamic operator model 12 ... a two layer neural network").

Regarding claim 32

Piche teaches said physical models and empirical methods are combined in series (fig. 28 shows prior art combine the models in series).

Regarding claim 33

Piche teaches said physical models and empirical methods are combined in parallel (fig. 2 shows dynamic model (physical) 22 in parallel with steady-state model (empirical) 20).

Allowable Subject Matter

9. Claims 23 and 24 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner *Thomas Pham*; whose telephone number is (571) 272-3689, Monday - Thursday from 6:30 AM - 5:00 PM EST or contact Supervisor *Mr. Anthony Knight* at (571) 272-3687.

Any response to this office action should be mailed to: **Commissioner for Patents, P.O. Box 1450, Alexandria VA 22313-1450.** Responses may also be faxed to the **official fax number (703) 872- 9306.**

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Thomas Pham
Patent Examiner

TP

November 24, 2004

Anthony Knight
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